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13. ABSTRACT (*Maximum 200 words*)

Several test samples were grown at the City College of New York MBE facility. The exact growth rate is unknown at present, but the nominal thickness are 12.5, 25, and 50 nm MnAs on 100 nm buffer layers of GaAs.

The substrate orientations are (001). GaAs buffer layers are p-type with a carrier concentration of $\sim 5 \times 10^{17}$ cm^{-3} and a thickness of ~100 nm. The nominal growth rate of MnAs was 50 nm/hour. Flux ratio of As/Mn was about 5-10. All the layers were annealed at 400°C for 1 minute after the growth (the time for increasing growth temperature from 250°C to 400°C was about 4 minutes.

Growth temperatures and growth times for MnAs layers are:

B94:	200C for 7 min. 30 sec.	250C for 42 min. 30 sec.
B95:	200C for 1 min.	250C for 30 min.
B96:	200C for 1 min.	250C for 14 min.

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We had access to MBE facility at City College of New York. We have grown several test samples. The exact growth rate is unknown at present, but the nominal thickness are 12.5, 25, and 50 nm MnAs on 100 nm buffer layers of GaAs.

The substrate orientations are (001). GaAs buffer layers are p-type with a carrier concentration of ~5×10^{17} cm^{-3} and a thickness of ~100 nm. The nominal growth rate of MnAs was 50 nm/hour. Flux ratio of As/Mn was about 5-10. All the layers were annealed at 400°C for 1 minute after the growth (the time for increasing growth temperature from 250°C to 400°C was about 4 minutes.

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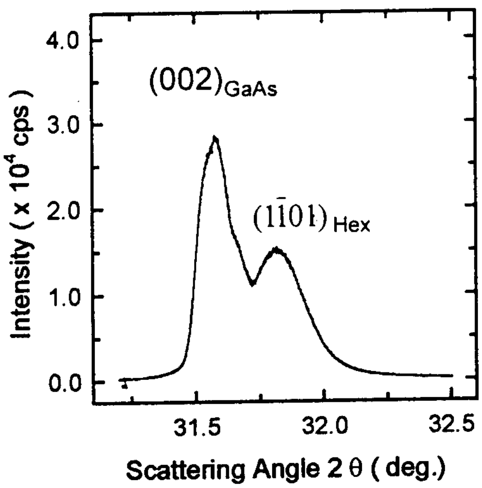
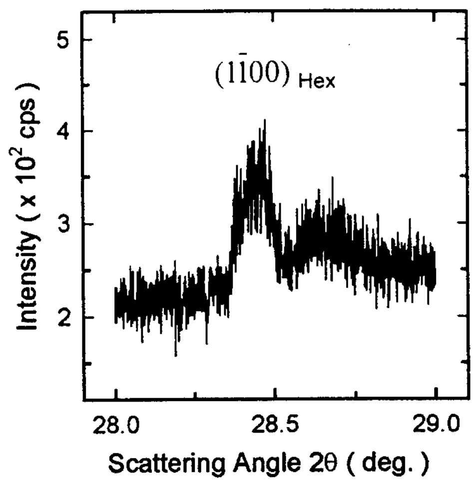
Next month, we will characterize the magnetic and optical properties of the samples: the effect of steady electric fields on hysteresis curves, MOKE and the index of refraction will be determined.

X-ray diffraction (XRD) spectra in θ-2θ scan revealed that at room temperature the MnAs film have mainly hexagonal phase whose plane parallel to the surface was mostly $(1\bar{1}01)$ and partially $(1\bar{1}00)$ at room temperature. Small volume fraction of orthorhombic phase (less then 4%) was also present in the film. It may be related to ununiform internal strain existed in the film. MnAs in bulk form takes the hexagonal structure and is ferromagnetic at room temperature and exhibits a first order phase transition at 40°C to a paramagnetic state with the orthorhombic structure. It is well known the magnetic properties and structure of MnAs are highly sensitive to pressure.

Although our first film was a mixture of hexagonal phases with two different growth orientation and orthorhombic phase, it can be controlled by changing growth conditions such as substrate temperature, Mn to As flux ratio and different thickness of GaAs buffer layer. Furthermore we presented that the easy direction of magnetization in film was controlled by predepositions of different first few atomic layer before growth of MnAs.





Typical XRD spectra of MnAs film in θ-2θ scan mode. Miller indices of scattering are shown above peaks. The most intense peak at the left hand side is related to the (002) plane of GaAs substrate.